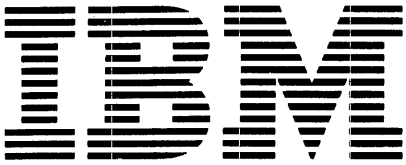


Application Program

H20-0227-0

1440/1460 Administrative Terminal System

(1440-CX-07X and 1460-CX-08X)

Console Operator's Manual

This system consists of control and functional programs that permit many different text-processing activities to be carried on simultaneously through different terminals. This reference manual contains information the console operator requires for running the program.

PREFACE

The material in this manual relates to Version 2 of the IBM 1440/1460 Administrative Terminal System program. It obsoletes and replaces the Preliminary Edition issued with Version 1 of the program.

This publication was prepared for production using the IBM 1440/1460 Administrative Terminal System. Page impressions for photo-offset printing were obtained from a typewriter terminal and then reduced 15 percent.

Copies of this and other IBM publications can be obtained through IBM Branch Offices. Address comments concerning the contents of this publication to IBM, Technical Publications Department, 112 East Post Road, White Plains, New York 10601.

CONTENTS

INTRODUCTION

The operator of a real-time system finds himself at the center of a complex of people, programs, and machines. He is the program's interface with the outside world and is the usual recipient of questions from the terminal operators and management.

The IBM Administrative Terminal System (ATS) is designed to run primarily unattended. However, when the operator's intervention is required, his actions are often critical. He must know what to do, and then must do it correctly the first time. The emphasis is on knowledge rather than on the ability to set switches and push buttons rapidly.

Real-time operations are different from the familiar batch operations. If the console operator makes a mistake in a batch operation, only machine time is lost while the job is rerun. On real-time operations, mistakes cost both computer time and productive time at the terminals.

It is important for the operator to know how and why operations are performed. For that reason, the first four sections of this manual contain background information. If the operator is interested in understanding the program in greater depth than is presented here, he is encouraged to read IBM 1440/1460 Administrative Terminal System, Programmer's Manual (H20-0228).

The computer operator is supplied with an ATS terminal to communicate with the system. It is essential that he be familiar with its operation as described in IBM 1440/1460 Administrative Terminal System, Terminal Operator's Manual (H20-0185). The operator should also be familiar with the ordinary operation of all units of the system on which ATS is operating, as described in IBM Systems Reference Library publications.

REAL-TIME OPERATIONS

A real-time system must react to random demands on its computing power. If the machine has stopped for an input/output operation, it cannot react to anything. For this reason, the primary rule of all real-time operations is "the computer must not stop". The stop button is ordinarily a forbidden item. Disk files must never be turned off while the system is operating. Any input/output device that is to be used by the computer must be ready before the computer is instructed to use it.

The word "loop" connotes an error condition in which the program has lost control of itself and executes the same instructions over and over. In a real-time system, however, the program "waits" for requests in a "loop". To avoid ambiguity, the normal looping of a real-time system is called cycling. To start such a system, one cycles it. When it is time to shut down, the operator tells the system to stop. After receiving this command and performing some necessary operations, the ATS progam halts and is cleared from core.

Visitors in the computer room must be watched carefully. Occasionally a visitor will lean against a Stop key or stop a disk file to "look at the label". Even experienced operators will occasionally forget and turn off a disk drive when looking for a missing disk pack. A programmer or operator may sometimes see the apparently deserted machine and "take it over for a short run". All of these potential disasters must be avoided.

Before the system is instructed to use any input/output device, the device must be ready. For example, if the program is instructed to read cards from the card reader and the reader is not ready, the whole system will wait until the card reader is ready. The basic rule for readying the equipment, such as the card reader or printer, is to press the Start key. This has no effect on the system, but it resets the hardware interlocks. In the case of the card reader, depressing the Start key also starts its motor, eliminating the delays caused by reading a card from an idle reader. Tapes should be checked and double-checked to be certain they are the right reels, on the correct tape drives, and not improperly file protected.

SYSTEM DESCRIPTION

ATS is a real-time processing system with up to 40 remote terminals. All of the terminals can operate at the same time. To each user, the computer appears to be servicing only the single terminal. As a text processing system, ATS primarily stores text keyed from the terminals and performs editing operations requested by the terminal operators.

BASIC MACHINE UNITS OF ATS

The basic machine units of a 1440/1460 ATS are:

IBM 1441 Processing Unit

IBM 1447 Console

IBM 1448 Transmission Control Unit

IBM 1311 Disk Storage Drives

Certain features of each of these units, except the 1441 Processing Unit, will be discussed below. Only those features which are important for ATS operation, and are not conveniently described in IBM Systems Reference Library publications, are described below.

A special ATS terminal, called "terminal zero", is used by the operator to transmit special requests to the ATS program. Operation of this terminal is described in IBM 1440/1460 Administrative Terminal System, Terminal Operator's Manual (H20-0185). The console operator must be familiar with the operation of this terminal.

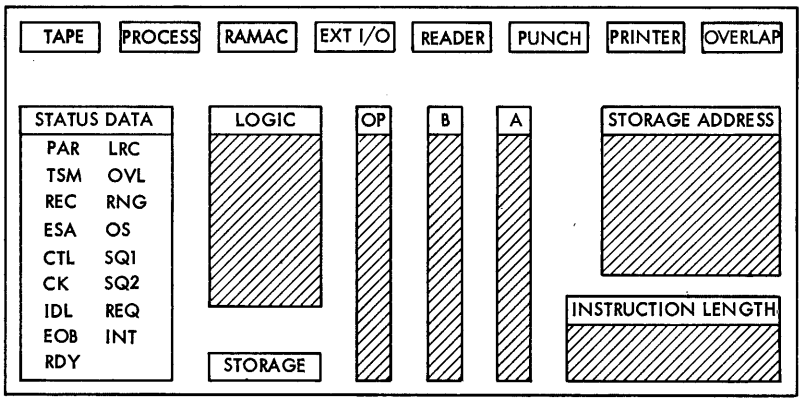
Particular attention should be given to the 1448 Transmission Control Unit and its controls. This is the unit that transfers characters typed at terminals to core storage, or transfers characters generated by the program to the terminal. The 1448 multiplexes, that is, allows simultaneous, unrelated activity on any or all of its lines. The terminals are connected to the 1448 by ordinary telephone lines. The special terminal set aside for the use of the computer operator comes into the 1448 on line zero, and is therefore called terminal zero.

IBM 1447 Console

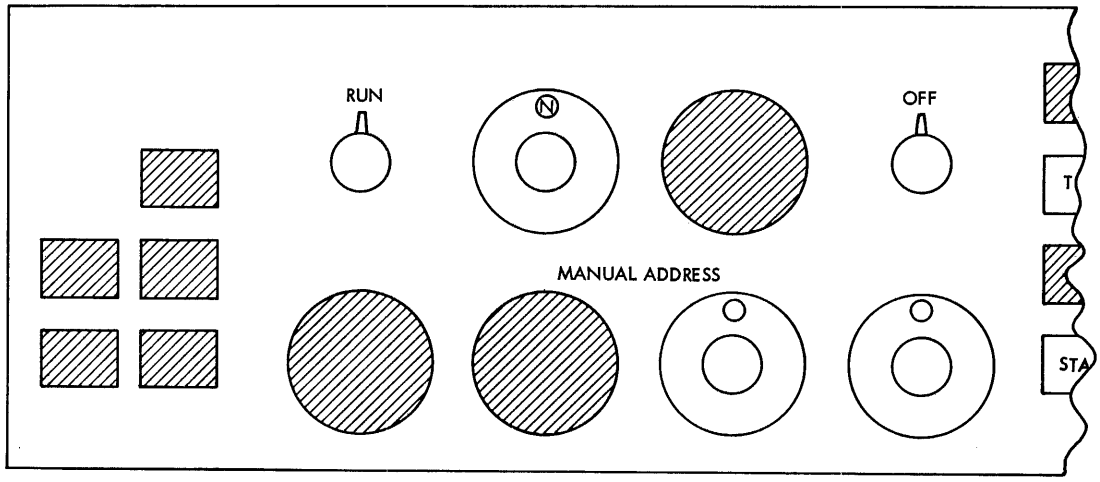
The IBM 1447 Console, Model 4, is a required unit in any ATS machine configuration. In addition to the usual computer switches, the console has a 1448 display panel and reset switch. In Figure 1, a diagram of the console panel shows the proper setting of all switches for ATS operation. These settings should be verified each time the operator is near the console.

Start Reset Button and 1448 Start Reset Switch

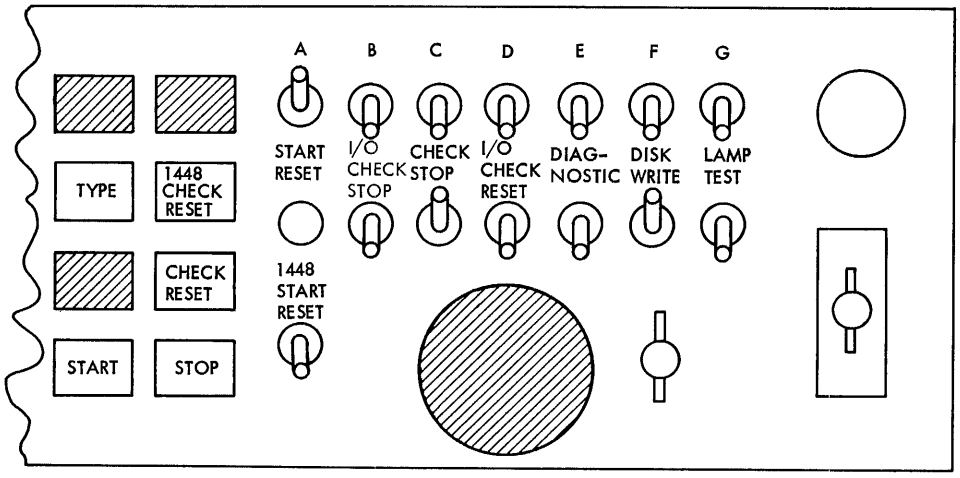
The black button marked START RESET resets the computer. This button should be pressed before ATS is cycled. It should not be touched while ATS is cycling.



INDICATOR LIGHT PANEL



SYSTEM OPERATING PANEL—LEFT HALF



SYSTEM OPERATING PANEL - RIGHT HALF

Note: Not all of the features shown will appear on the console of every system.

Figure 1. IBM 1447 Console, Model 4, panel

Immediately below the Start Reset button is a toggle switch marked 1448 Start Reset. It resets the 1448 Transmission Control Unit. This switch should be pressed up at the same time that the Start Reset button is pressed. It should not be touched while ATS is cycling.

Mode Selection Dial

The Mode Selection dial allows a number of diagnostic modes for debugging and altering programs. During normal running conditions, the dial should point straight up in the RUN position. If the switch is not set to RUN, the computer will not cycle the ATS program.

I/O Check Stop Switch

When the I/O Check Stop switch is ON, the computer will stop if there is an error condition in the card reader, card punch, or the line printer. If it is OFF, the computer will continue to operate, and the program must check for I/O errors. When ATS is running, this switch should be OFF (down).

Check Stop Switch

This switch controls the response of the computer to parity errors in core memory. If the switch is ON (up), the computer will halt when a parity error occurs. If the switch is OFF (down), the computer will not halt. In either case, the Check Reset light will be illuminated when a parity error occurs. When ATS is running, this switch should be ON (up).

Diagnostic Switch

This switch is used by the IBM Customer Engineer and should always be in the OFF position during normal system cycling.

Disk Write Switch

If the Disk Write switch is OFF, the program cannot write disk records. When ATS is running, this switch must be ON.

Power On Switch

The Power On switch is located on the extreme right of the console panel. This switch controls the main power supply for the entire system. Power is brought up and down by means of this switch.

Emergency Pull

Located in the upper right corner of the console is a red knob marked EMERGENCY PULL. Pulling this switch will drop power immediately, and it is used only in cases of emergency. If it is pulled, the Customer Engineer must be called to restore it. It should never be used for normal Power Off.

Program Load Key

On the 1447 Console of a 1440 system there is a key marked Program Load, and on the 1402 Card Read Punch of a 1460 system there is a key marked Load. These keys are used to start a program that is read from cards. The first few cards of such a program are a small subprogram called a bootstrap. The Load key starts the bootstrap program operating; it, in turn, loads the main program into the machine and gives it control. Before the Load key is pressed, the console should be "readied" (see below).

Readying the Console

Throughout this manual the phrase "Ready the Console" will be used. This means setting the Mode Selection dial to RUN, pressing the Start Reset button and the 1448 Start Reset switch (and the Check Reset key light, if it is lighted).

NOTE: The console should be readied only when the processor is stopped.

Some components of the system have meters with small toggle switches marked ON and OFF. When the switch is ON, the meter for that component will operate. When the switch is OFF, that component is unavailable to the program. The operator should be sure all meter switches are ON for all components used by the ATS program. The locations of meter switches on the more important units of an ATS machine configuration are:

Machine Unit	Location of Switch
1447 Console	Right rear of unit
1448 Multiplexer	Side panel
1311 Disk Drives	Front panel, next to ON-OFF button
1301 Disk Storage	Side panel

Altering and Displaying Core

The 1447 Console Input/Output Printer is useful for displaying or altering small sections of core storage. To display or alter, the B-address register must be set to the appropriate high-order storage address. This is done by setting the desired address on the four address dials. The computer must be stopped and the Start Reset button pressed. All characters printed on the typewriter or typed into core go through the B-register. For this reason, the square key marked B ADD REG must be pressed. The Mode Selection dial must then

be turned to ALTER and the Start key pressed. This will set the address in the address dials into the B-address register. This action communicates the location of the characters to be displayed or altered. By leaving the Mode Selection dial in the ALTER mode and pressing the Type key, any characters typed on the console typewriter will go into core storage beginning at the indicated address. If the Mode Selection dial is turned to CHARACTER DISPLAY and the Type key is pressed, the contents of core storage will be typed on the typewriter beginning at the indicated address. To return to a normal operating status, the Mode Selection dial must be set to the RUN position.

Branching to an Address

In certain rare instances, it will be necessary to force the computer to start at a given address. The desired starting address is first set in the address dials. The computer is stopped, and the Start Reset button is depressed. The Mode Selection dial is set to ALTER. The Instruction Address key (I ADD REG) is pressed, followed by the Start key. This places the address from the dials into the Instruction Address register. The Mode Selection dial should then be returned to the RUN position. When the Start key is pressed again, the computer will begin executing instructions beginning at the address in the Instruction Address register.

IBM 1448 Transmission Control Unit

The 1448 Transmission Control Unit is the interface between the computer and the terminals. Each terminal is connected by a telephone line to an adapter in the 1448. These adapters are numbered beginning at 0. Thus, if there are 40 terminals on the system, the Line Adapters (lines) are numbered from 0 through 39. For convenience, the terminals are numbered according to the lines to which they are attached.

Text coming into the system from a terminal flows through the appropriate line into the 1448, and from the 1448 into core storage. When a block of characters has been accumulated, it is written to the disk.

Line Status

The system may be receiving text, transmitting text, or neither receiving nor transmitting on any line. The status of any attached line may be displayed in the indicator light panel by setting the two low-order address dials to the 1448 line number. The status of the line will be shown by a Status Indicator light.

When the computer is receiving text from the terminal, the status is Receive and is shown in the lights as:

REC

When the computer is transmitting text to the terminal, the status is Transmit and is shown in the lights as:

TSM

Whenever the program is processing a request it sets the status to Control, which effectively blocks any characters typed from reaching core storage. This status is shown in the lights as:

CTL

The program initially instructs the 1448 to accept characters by setting the status of the line to Receive-Idle. As soon as characters arrive from the terminal, the status changes to Receive. Whenever a terminal operator hits the Attention or Carrier Return keys, the terminal keyboard locks. When the program sets the status to Receive-Idle, the 1448 sends the Keyboard-Unlock character to the terminal. Thus, after every Carrier Return and Attention, the line is set to Receive-Idle status to unlock the terminal keyboard and prepare the 1448 to receive text. This status is shown in the lights as:

REC

IDL

If a character with invalid parity arrives from a terminal, the 1448 will change the status from Receive to Receive-Check. This status is shown in the lights as:

REC

CHK

If a terminal is in the offline condition (no initial Attention-U or Attention-A action), or in certain rare peak-load conditions, the program may not have space for the characters coming from the terminal. If this should happen, the status will appear as Receive, End of Storage Area. A terminal in the offline condition is assigned a four-character area. When the fifth character is received, the status changes to Receive, End of Storage Area. This status is shown in the lights as:

REC

ESA

The program must examine the status of every line attached to the 1448. For that reason, the program must know the number of lines attached. The 1448 has circuitry that checks the program to be certain that it is examining all the lines that it should. If the program should fail in this respect, the 1448 will halt the computer (Check Reset) and the Out of Step status will appear in the lights for every line. This status is shown in the lights as:

OS

Whenever the 1448 requires attention, it interrupts the program. After the program examines the lines, it returns to the interrupted instructions. This normally occurs every tenth of a second--too fast to show in the lights. However, if the program is unable to interrupt, the Request Interrupt status will show. This status will occur if the Stop key is pushed, if the computer is waiting for an input/output operation, or if the computer halts. This status is shown in the lights as:

REQ

1448 Control Panel

The 1448 control panel is located behind the doors at the front of the unit. Normally, there is no reason for anyone but the Customer Engineer to work with the control panel. However, there is one switch of interest called the Text Time Out. Text Time Out is not used by the ATS, and the switch must always be OFF (up) when ATS is running.

IBM 1311 Disk Drives

ATS will have from one to five 1311 Disk Storage Drives containing removable disk packs. A disk pack consists of six disks mounted on a spindle. Information is read or written on the disks by read-write heads mounted on a movable access arm. The read-write heads "float" on a slender film of air a few millionths of an inch thick. Because of this tolerance, dust particles may ruin a disk pack. The Customer Engineer will clean the packs and the read-write heads as part of his regular maintenance, but the operator should exercise all reasonable care when handling the packs to avoid contamination. The packs should be kept in their sealed containers or on the drives, with the drive covers shut.

The 1311 Disk Storage Drive is started by pressing the Start-Stop key to the left of the front window. When the disk has arrived at the proper speed, the green light containing the drive number will be illuminated. The disks are then ready for use.

ATS PROGRAM

The ATS program consists of a number of smaller programs, each with its own function. A list of the ATS programs is contained in the IBM 1440/1460 Administrative Terminal System, Programmer's Manual (H20-0228).

The master program, called the Scheduler, controls the interaction of the other functional or application programs. The application programs are requested by the actions taken at the terminals. Each program performs a certain type of action. For example, the COINS program finds previously entered lines so they may be corrected. The FRPRT program generates the output stream when a terminal requests a typeout.

Program Overlays

The ATS is much too large to reside in core storage. It resides in the disk storage. The application programs are read into core as they are needed. The Scheduler, however, is always resident in core and decides which application programs should be read in and activated.

The main portion of all application programs is 20 sectors long on the disk, and occupies 1,800 positions of core storage. Many of the programs are much larger than this; their additional parts are broken up into segments ten sectors in length, called overlays. These overlays are called into core storage by the program as they are needed.

In the ATS all programs and overlays are designated by five-character names. For example, Format and Print, the program that generates output to the terminals, is called FRPRT. Its overlays are given the first few letters of the program name plus the number of the overlay. For example, FRPRT has six overlays marked FRPR1, FRPR2, FRPR3, FRPR4, FRPR5, and FRPR6.

Program Modifications

Whenever errors in a program are uncovered, program modifications will be sent to all ATS users registered with the IBM Program Information Department. These modifications will normally be in the form of replacement object program decks for particular programs. The new program decks are then read onto the disk, using the procedures described in the section entitled "PATCHING System Parameters".

Calling Programs from Disk Storage

Once the programs have been loaded onto the disk, the card decks are no longer necessary for normal operations. Whenever a particular program is desired, it is called from disk into core storage by the bootstrap program. This program is named the Call Monitor program. It has the five-character name CALLM punched into columns 76 through 80 of the object deck. The Call Monitor program contains its own loader. When it is loaded, the console Type light is turned on. The operator may then type the name of any program in disk storage that he wants to execute. For example, to cycle the ATS program the operator types:

ATS

PROGRAM LAYOUT AND OPERATION

Core Storage

Figure 2 contains the allocation of core storage for ATS. Positions 0 through 332 are the areas in which images are assembled for the various peripheral devices. Positions 1 through 80 receive card images from the card reader; positions 101 through 180 receive card images that will be punched into cards; positions 201 through 332 contain images for the printer. Position 81 contains an unconditional branch that recycles the system, should a peripheral tape/printer hang-up occur. The remaining characters in this area contain the index registers and certain portions of the Scheduler.

The major portion of the Scheduler is located in positions 333 through 5900. The Scheduler controls and schedules the work done by ATS. The work is performed by the application programs that are read into the overlay area as they are needed, one program at a time. Permanent Storage half-tracks are manipulated in the half-track area by the application programs that work with Permanent Storage. Other application programs use the half-track area for data or program overlays. Tasks that are to be performed are queued in the List Area. Other control information is stored in various system tables.

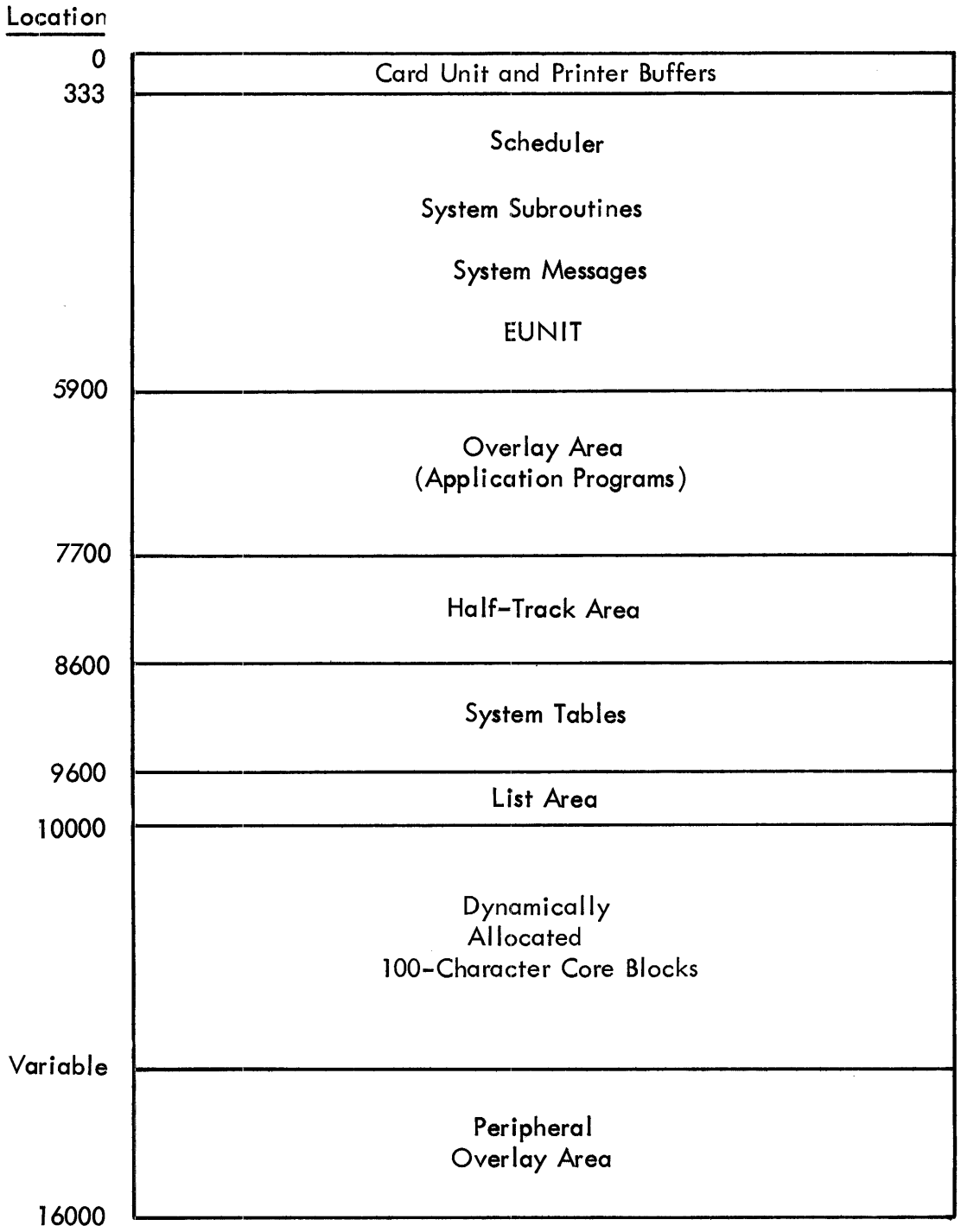


Figure 2. Core storage allocation

A large data area, composed of blocks of 100 characters, follows the List Area. These blocks hold the text being received from or transmitted to the terminals. The number of blocks required depends on the number of terminals attached to the system, and their activity.

If the number of core blocks is not too large, it is possible to use the unused positions of core storage for special peripheral programs to perform card-to-tape, tape-to-printer, or similar operations simultaneously with the operation of ATS. Two such programs are furnished with ATS. They occupy the upper 1900 positions of core. If they are to be used, the number of core blocks allowed for terminals must be 41 or less. In addition, programs may be written by users in order to take advantage of their particular system configuration.

When a terminal wishes to go online to begin using the system, the Scheduler checks to be certain there are enough core blocks to accommodate the additional terminal. If there are not, the terminal will receive the message:

GO ON-LINE

and will not be allowed to operate. The system requires six free blocks for its own use. If there are seven or more free blocks, the Scheduler will allow the terminal online. The least number of core blocks necessary to operate ATS is thus equal to the number of terminals that will be simultaneously active, plus six. Because of hardware considerations, the highest block may not be used as a core block. Thus, the maximum number of core blocks that may be assigned is 59.

It is difficult to recommend the number of core blocks that will be needed, since ATS applications vary widely. A rule of thumb is 1.5 core blocks per active terminal, or 59 core blocks for a 40-terminal system. For a moderately active system, 1.25 core blocks per terminal should suffice, or 50 core blocks for a 40-terminal system. Many installations will find that all of their terminals are not active simultaneously. Core blocks may then be allocated according to the number of active terminals. The operator may change the number of core blocks being used by the system whenever necessary. The ATS program must be shut down, a new patch card made, and the program reloaded to accomplish this change. This procedure is described in the section "The First Day - Preparing to Run ATS", below.

Disk Storage

The 1311 Disk Storage Drives are numbered beginning at 0. Since there are five possible drives in any one system, the drives are numbered 0 through 4. The drives are never in line according to number. Drive 0 is always in the center, with the satellite drives placed on the left and right.

The disk addresses ascend sequentially from the first cylinder of drive 0 to the last cylinder of drive 4. Addresses 000000 through 019999 apply to drive 0. The lowest address on drive 1 is 020000, located at the bottom of the outermost cylinder. This progression continues through the remaining drives, as follows:

Drive	Sector Addresses	Cylinders
0	000000 to 019999	0 to 99
1	020000 to 039999	100 to 199
2	040000 to 059999	200 to 299
3	060000 to 079999	300 to 399
4	080000 to 099999	400 to 499

Disk storage may be considered as a sequential series of cylinders. The computer accesses the drive corresponding to the sector address specified by the program. The program conveys this information through a ten-character field called a disk control field. This field precedes the information to be read (written) into (from) core storage. The disk control field to read the FRPRT program from the disk, for example, looks like this:

*000100020

The asterisk is called the drive designator. It will be an asterisk when the sector resides on a disk pack; it will be a right parenthesis (or lozenge) if the sector resides on 1301 Disk Storage. The next six characters of the disk control field contain the sector address. The final three characters contain the number of sectors to be read or written. A read disk command which addresses the asterisk in the above example would read 20 sectors beginning at disk sector 100. The information would be read from sectors 100 to 119--a block 20 sectors long.

Disk Storage Allocation

Disk storage is used for five purposes in ATS: programs, data, Working Storage, Permanent Storage Index, and Permanent Storage. Figure 3 shows the disk allocation for ATS.

The first ten cylinders hold programs and three data areas, the First Block Area, the Permanent Storage Bit Map, and the CORED-ATSDD Work Area.

The CORED-ATSDD Work Area is used for temporary storage when the CORED and ATSDD programs are operating (see "ATS Utility Programs"). It may also be temporarily used by user-written programs.

Each terminal is numbered, beginning at 0 and extending through 39. Similarly numbered disk sectors are assigned as the first block for the correspondingly numbered terminals. The First Block (FBK) for terminal 0 is sector 0; the FBK for terminal 1 is sector 1, etc. Thus the First Block Area begins at sector 0 and extends through sector 39. The last five characters of every FBK contain the disk address of the first sector of Working Storage for that terminal. If it is blank, the terminal has no Working Storage; that is, it is in the offline or cleared status. The other characters in the FBK specify the terminal's tab settings, page depth, and line width, to name just a few of the fields.

Permanent Storage is stored in sections of ten sectors called half-tracks. Each bit in the Permanent Storage Bit Map corresponds to a particular half-track of permanent storage. When a half-track is used, its bit in the bit map is on; when the half-track is available, its bit is off.

Working Storage

Keystrokes from the terminals are written in the Working Storage section of the disk, one sector at a time. There is no specifically defined Working Storage area for a given terminal. Working Storage

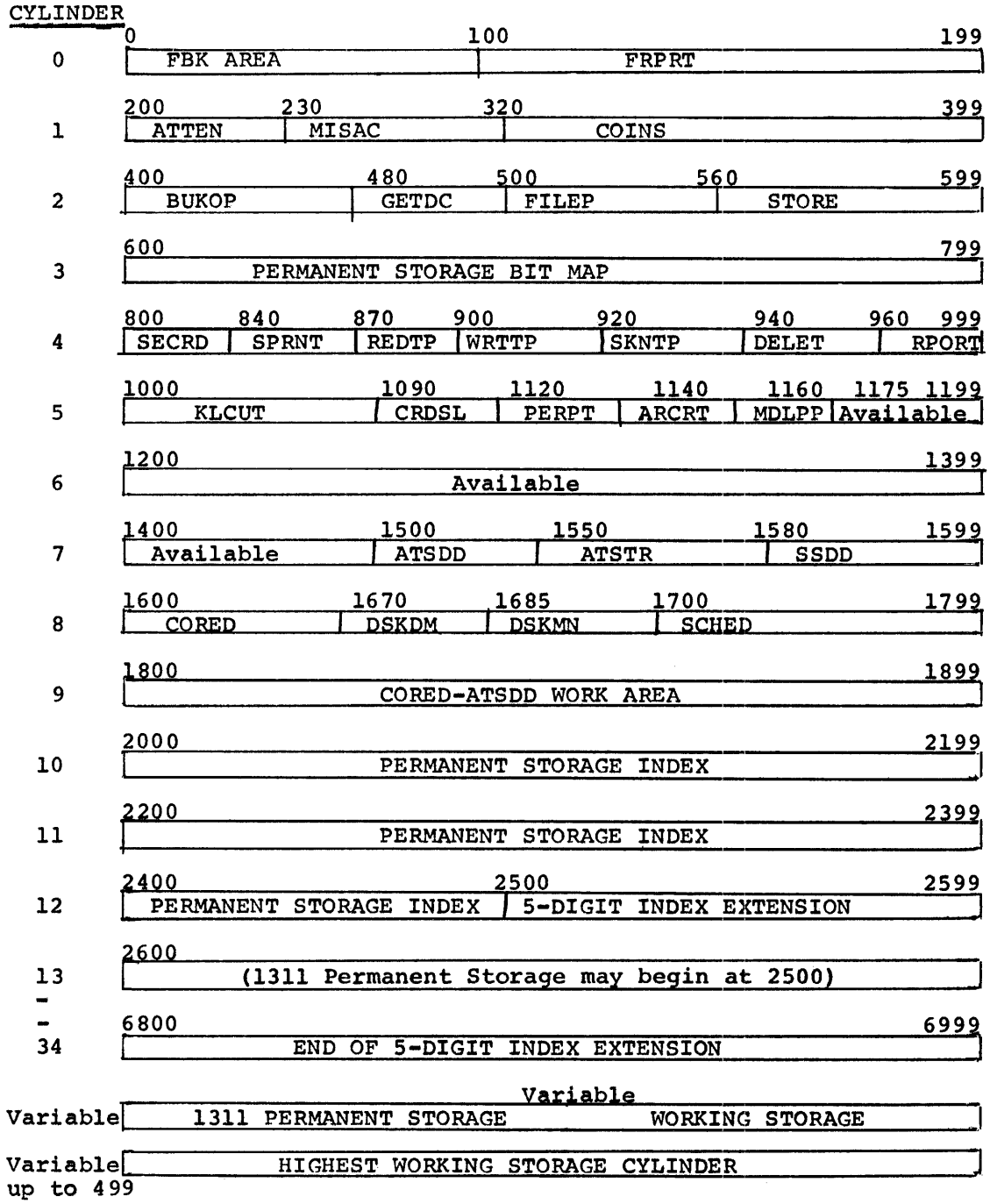


Figure 3. Disk storage allocation

for all terminals begins at a specified sector address (see "Patching System Parameters") and gradually grows downward. Each time a new date is entered on the console (see "Normal Operations"), it starts again at the specified address. The Working Storage of one terminal is kept separate from the Working Storage of other terminals through a chaining technique, which is also known as dynamic storage allocation. Every Working Storage sector contains the disk address of the Working Storage sector which follows in sequence. Consider a document (shown in Figure 4) that contains enough text to fill three Working Storage sectors. The beginning of the document would be in the sector on the left, while the end of the document would be in the sector on the right.

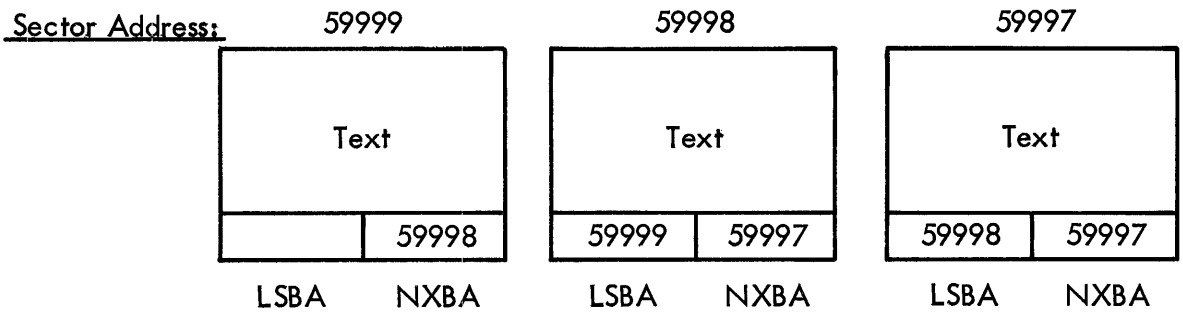


Figure 4. Working storage with two-way chaining

Note that the last five characters of each Working Storage sector contain the address of the next sector that follows in the document sequence. This is called the forward chaining address. The last sector of the chain "points" to itself, which means the chaining address of the last sector is the same as its address. Since one sector always points to the next link of the chain, the Working Storage for the terminals does not need to be sequentially assigned.

In addition to forward chaining addresses, Working Storage sectors also contain the addresses of preceding links or sectors. The forward chaining address is called the NXBA (Next Block Address); the backward chaining address is called the LSBA (Last Block Address).

Permanent Storage Index

Following the first ten cylinders of program and data is the Permanent Storage Index. If five-digit document numbers are allowed, it occupies 25 cylinders; if four-digit document numbers are used, it occupies 2 1/2 cylinders. The Permanent Storage Index consists of four-character entries -- one for every possible document number. If the entry is blank, the document number is available. The four-character entry represents the disk address of the first half-track of that particular document.

Permanent Storage Operation

Documents stored for later reference are located in permanent storage. The Permanent Storage area circulates between a specified upper and lower bound on disk (see "Patching System Parameters"). This area is mapped in the Permanent Storage Bit Map and its contents are referenced in the Permanent Storage Index. When a document is deleted, its four-position index entry is cleared and its half-tracks are made available in the bit map for future storage.

A chaining technique is also used with Permanent Storage. Instead of chaining single sectors, Permanent Storage chains half-tracks (ten sectors). The address of a half-track is always a multiple of ten. Since the low-order digit is always zero, the addresses of half-tracks are stored as four digits with a low-order and a high-order zero understood. For example, address 3255 is understood to mean 032550. A disk control field to read or write that half-track would appear as follows:

```
*035550010
```

An example is shown in Figure 5.

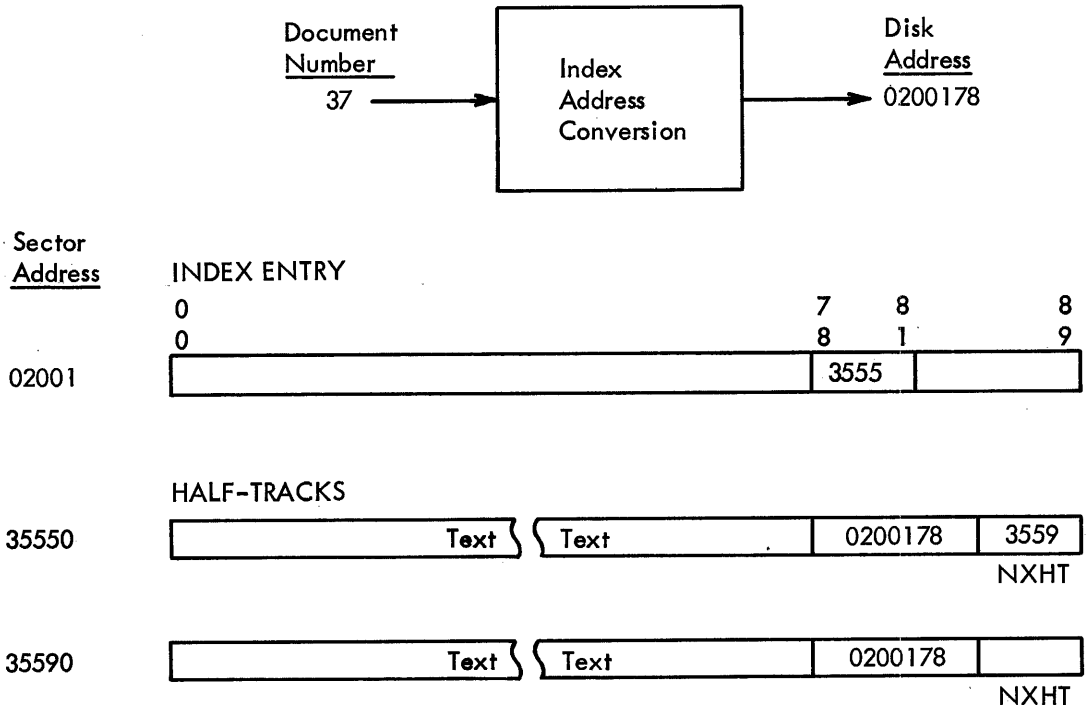


Figure 5. Example of permanent storage

Permanent Storage half-tracks are chained in the forward direction only. The last four characters of the half-track contain the address of the next half-track in the document. This field is called the Next Half-Track (NXHT). The seven-character field preceding NXHT contains the sector address, and character address within the sector, of the index entry corresponding to that document. Since this reference is to a specific index sector, on drive 0, the high-order zero of the

sector is understood, leaving five digits for the sector address. Specific characters within sectors are numbered from 00 to 89. The character address designates the high-order (the leftmost) character in the index entry.

The first sector of the first half-track of every document contains status information which appears as follows:

Character Address	Mnemonic	Contents
0-49	DCID	Document identification
50-53		Blank
54	DCRL	Reel character, if it is on a Permanent Storage Tape
55-59	DCNM	Reel number, if it is on a Permanent Storage Tape
60-61	DCOT	Number of storing terminal
62-63		Blank
64-69	DCDC	Date document was stored
70-71	DCQH	Number of half-tracks used
72-73		Blank
74	DCMD	Mode of last unit in document
75		Blank
76-79	DCUN	Number of units in document
80-84	DCLW	Lock word
85-89		Blank

The end of a Permanent Storage chain is indicated when the chaining address (NXHT) is blank.

Permanent Storage Index Address Conversion

A document is assigned a number at the time it is stored. For example, the action:

ATTN s37 CR

stores a document in what can be considered as location 37. Clearly, the number 37 does not mean that particular disk sector (sector 37 is the FBK for terminal 37). The ATS program converts the number 37 to a specific disk sector address and character address within that sector of the Permanent Storage Index. For document 37, shown in Figure 5, it is sector 02001, character 78. This location is the address of the high-order character of the index entry corresponding to the document. That four-character entry contains the address of the first half-track of the document.

The address of the index entry for a document (called INBA-Index Block Address) can be found by dividing the document number by 20. This quotient, plus 02000 is the sector of the appropriate index entry. Divide the remainder by 10. The character address within the index sector is 50 times this new quotient, plus 4 times this new remainder. Schematically this computation is as follows (where D is the document number):

```
                D/20 = Q and R
                R/10 = q and r
   sector address = Q + 02000
character address = 50*q + 4*r
```

The conversion for document 37 is, for example:

```
                37/20 = 1 and 17
                17/10 = 1 and 7
   sector address = 1 + 02000 = 02001
character address = 50*1 + 4*7 = 78
```

To convert an index block address (INBA) to the document number it represents, a reverse procedure is used. If the character address is 50 or more, reduce it by 10. Divide this number by 4 and add it to 20 times the difference between the sector address and 02000. Schematically, this computation is as follows (where s means sector address and c means character address):

```
20(s - 02000) + (c /4)       = D [if c is 00-36]
20(s - 02000) + ((c -10)/4) = D [if c is 50-86]
```

The conversion from 0200178 is, for example:

```
20(02001 - 02000) + ((78-10)/4) = D
20(1) + (68/4) = 20 + 17 = 37
```

This method of computation does not assign index entries to character positions 40 through 49. In the first 100 sectors of the index, character position 40 is used as a pointer for waiting messages. If the character address of the INBA is 40, the terminal that will receive the message is indicated by the two low-order digits of the sector address. For example, INBA = 0200040 is the index entry for waiting messages for terminal 0, and INBA = 0209940 is the entry for terminal 99.

Terminals 0 through 39 are normal ATS terminals. Terminals 40 through 99 are special output devices as follows:

Terminal Number	Output Device
40-95	Unassigned
99	Card punch (1402 or 1442)
98	Printer (1403 or 1443) or output tape
97	Output tape
96	Upper- and lowercase chain printer or output tape

In all cases, a blank index entry indicates no document or message waiting.

BASIC ATS OPERATIONS

THE FIRST DAY--PREPARING TO RUN ATS

The ATS program is very easy to activate. Only the disk packs require preparation before loading the program decks. The operator then describes his particular system configuration to the program, which automatically adjusts itself accordingly.

Preparing the Disk Packs

It is a good operating practice to label the disk packs. The label should go directly on the pack, not on the cover. The pack must first be mounted on the drive, and the protective cover removed. Pencils should not be used for labeling because of the temptation to erase. The rubber from an erasure may ruin a disk pack. The best labels are adhesive backed. Each pack should be labeled with its appropriate drive number. A sample label might be:

ATS -- Drive 0

After the packs have been mounted and labeled, the appropriate addresses must be written. All the packs are addressed in the Load Mode in true address format. The ATS program itself may be used to write the addresses.

Normally a program has no access to the addresses written on the disk. To allow this access, the Write Address key must be pressed and the Compare Disable key lock switch turned ON. They are both located on drive 0.

Writing Addresses on the Drive Zero Pack

The first step in loading the ATS program is to write addresses on the drive 0 disk pack. There are two possible procedures - one using ATS and the other an IBM Clear Disk Utility Program (1401-UT-053 for 1460 systems or 1440-UT-041 for 1440 systems).

To use ATS to write addresses on drive 0, the Disk Load (DSKLD) and Scheduler (SCHED) programs should be separated from the ATS object program deck. These programs should then be placed in the card reader, DSKLD first. The console should be readied and the Load key pressed. The card reader will pause on the last card. At this point, the console should again be readied, Sense Switch B set ON (up) and a manual branch to core location 5900 executed. The program will type:

WHAT'S NEW?

on the 1447 Console Input/Output Printer. The system is told to write addresses on the drive 0 pack by typing:

WRITE 0 RELEASE

where RELEASE means press the Release key. The program will type:

'WRITE-ADDRESS' ON--INHIBIT ADDR COMPARE CHECKING

and halt. The Write Address key on drive 0 should be pressed on (lighted) and the Compare Disable Switch turned ON. When the Start key is pressed, the program will write addresses on the drive 0 pack. After this is accomplished, the program will type:

RESTORE 1311 STATUS

and halt. The Write-Address key should be pressed off (unlighted) and the Compare Disable Switch turned OFF. The pack is now ready for loading ATS program.

If an IBM Clear Disk Utility Program is to be used to write addresses on drive 0, a control card should be punched in the following format:

Card Columns	Contents
1	L
2- 7	000000
8-13	019999
14-15	00

DATE and RDLIN cards are not required for this operation. Before running the program, the Write Address key should be pressed, the Compare Disable switch should be turned ON, and the drive started. When the drive is ready, the green light containing the drive number will light up. The printer and console should be readied and the program placed into the card reader with the control card at the end of the deck. When the Load key is pressed, the program will be loaded and the card reader will pause on the last card. The Start key must be pressed to read it. The program will log the information on the control card on the printer and halt. When the Start key is pressed, addresses will be written on drive 0. Detailed operating instructions may be found in the publications Disk Utility Programs Specifications, IBM 1401, 1440, 1460 (with IBM 1301 and 1311) (C24-1484), and Disk Utility Programs Operating Procedures, IBM 1401 and 1460 (with 1301 and 1311) (C24-3105) or Disk Utility Programs Operating Procedures, IBM 1440-1311, IBM 1440-1301 (C24-3121).

Writing Addresses on Additional Packs and Modules

Mount a new pack on drive 1, 2, 3, or 4. Turn sense switch B ON and cycle ATS. After the message:

WHAT'S NEW?

appears, type:

WRITE # RELEASE

where # is the disk drive number on which the new pack is mounted. The remaining procedure is identical to writing addresses on drive 0. Writing addresses on disk packs may also be done with the IBM

Clear Disk Utility Programs mentioned above. Writing addresses on 1301 Disk Storage modules must be done with the IBM Clear Disk Utility Programs.

Patching System Parameters

ATS is initially set for a minimum configuration, namely, a one-line, one-drive 1440 system. By changing certain parameters, it is possible (1) to vary the upper and lower bounds of Permanent Storage, the upper and lower bounds of Working Storage, the number of attached terminal lines, the number of core blocks to be used, and the Permanent Storage Tape "write" drive, (2) to indicate the presence of a 1460 system, a 1- to 5-module 1301, the Translate feature, a printer, a printer with upper- and lowercase chain, a punch, or (3) to allow five-digit document numbers to be used. Each change is done by adding a patch card of a specified format immediately in front of the last card in the COMPOOL object deck. The COMPOOL deck consists initially of eight cards having the ID of ///// (zero-1 punches) in columns 76 through 80.

Highest Permanent Storage Address (HPSA)

HPSA is a five-digit field (low-order zero understood) indicating the upper bound of permanent storage. It comes assembled as 01500 (underlined digits are wordmarked), which is interpreted as sector 015000 on the 1311. For 1311 systems it should equal the same logical address as the Lowest Working Storage Address (LWSA). The omission of low-order and high-order zeros will make the value in the patch card for HPSA ten times that in the patch card for LWSA. For 1301 systems it should be set to 20000 times the number of modules. (Use 99999 for a five-module system.) The patch card format is:

Card Columns	Contents
1-2	61
3	! (11-0)
4-5	05
6	Word separator (0-5-8)
7-11	New value of HPSA
12-71	Comment: HIGH PERM STORE ADDR
72-80	0400/////

Lowest Permanent Storage Address (LPSA)

LPSA is a five-digit field (low-order zero understood) indicating the lower bound of permanent storage. It comes assembled as 00250, which is interpreted as sector 002500 on the 1311. For 1311 systems allowing five-digit document numbers, it should be set to 00700. For 1301 systems it should be set to 00000. The patch card format is:

Card Columns	Contents
1-2	60
3	! (11-0 punch)
4-5	10
6	Word separator (0-5-8 punch)
7-11	New value of LPSA
12	Word separator (0-5-8 punch)
13-17	New value of LPSA
18-71	Comment: LOW PERM STORE ADDR
72-80	0400/////

Highest Working Storage Address (HWSA)

HWSA is a five-digit field (high-order zero understood) indicating the upper bound of working storage. It comes assembled as 20000, which is interpreted as sector 020000 on the 1311. It should be set to 20000 times the number of 1311 drives. (Use 99999 for a five-drive 1311 system.) The patch card format is:

Card Columns	Contents
1-5	62N05
6	Word separator (0-5-8 punch)
7-11	New value of HWSA
12-71	Comment: HIGH WORKING STORE ADDR
72-80	0400/////

Lowest Working Storage Address (LWSA)

LWSA is a five-digit field (high-order zero understood) indicating the lower bound of working storage. It comes assembled as 15000, which is interpreted as 015000 on the 1311. For 1311 systems it should be set to 20000 times the number of drives minus a constant. This constant is the total number of sectors allowed for working storage. 5000 sectors is generally sufficient for working storage. (For example, LWSA equals 35000 for a two-drive system.) For 1301 systems it should be set to 07000. The patch card format is:

Card Columns	Contents
1-5	61N05
6	Word separator (0-5-8 punch)
7-11	New value of LWSA
12-71	Comment: LOW WORKING STORE ADDR
72-80	0400/////

Output Devices

The assembled system assumes no output devices. A patch card is required for each output device attached. These devices are given special terminal numbers. For a 1403 Printer with an uppercase and lowercase chain (terminal 96) the patch card format is:

Card Columns	Contents
1-2	63
3	O (11-6 punch)
4-5	01
6	Word separator (0-5-8 punch)
7	Delta (11-7-8 punch)
8-71	An appropriate identifying comment
72-80	0400/////

For card-image magnetic tape (terminal 97) use the above card format, but use P in column 3. For 48-character printout with line numbers (terminal 98) use the above card format, but use Q in column 3. For a card punch (terminal 99) use the above card format, but use R in column 3.

IBM 1301 Disk Storage and Five-Digit Numbers Allowed

A single indicator is used for these two functions. ATS is assembled and distributed for a 1311 system with 9999 as the maximum document number. If a 1301 is used for permanent storage with 9999 as the maximum document number, punch the following patch card:

Card Columns	Contents
1-2	64
3	! (11-0 punch)
4-5	01
6	Number of 1301 modules
7	Blank
8-71	An appropriate identifying comment
72-80	0400/////

If a 1301 is present and five-digit document numbers are to be allowed use the above format, but change:

Card Columns	Contents
6	Word separator (0-5-8 punch)
7	Number of 1301 modules

If a 1311 system is to allow five-digit document numbers, change:

Card Columns	Contents
6	Word separator (0-5-8 punch)
7	Blank

Permanent Storage Tape Drive Number

Permanent Storage Tapes may be read from any tape drive, but must be written on a particular drive. The "write" drive is assembled as unit 1. If another unit number is desired, punch the following patch card:

Card Columns	Contents
1-5	64J01
6	Unit number (1 through 6)
7-71	Comment: TAPE WRITE UNIT
72-80	0400/////

Computer Type and Translate Feature

A single indicator is used for these two functions. ATS is assembled and distributed for a 1440 system with no Translate feature. If a 1440 system has the Translate feature, punch the following patch card:

Card Columns	Contents
1-5	64K01
6	Word separator (0-5-8 punch)
7	4
8-71	An appropriate identifying comment
72-80	0400/////

If a 1460 system is used without the Translate feature, use the above format, but change:

Card Columns	Contents
6	6
7	Blank

If a 1460 system is used with the Translate feature, change:

Card Columns	Contents
6	Word separator (0-5-8 punch)
7	6

Number of Attached Lines

ATLI is a two-position field indicating the number of lines that the 1448 Transmission Control Unit has been modified to handle. If this number is not known, ask the Customer Engineer. It comes assembled as 01, for one line. The maximum number of lines that may be attached is 40. The patch card format is:

Card Columns	Contents
1-5	64L02
6	Word separator (0-5-8 punch)
7-8	New value of ATLI
9-71	An appropriate identifying comment
72-80	0400/////

Number of Core Blocks

NAVB is a two-position field indicating the number of core blocks available for text in core. It comes assembled for ten core blocks. The value of NAVB should be approximately one and one-half times the value of ATLI. The permissible range of NAVB is 10 to 59. If NAVB is set to a value greater than 41, the core blocks will overlap the peripheral program area defined in ATS as assembled and distributed. This overlap will prevent proper execution of peripheral programs (see IBM 1440/1460 Administrative Terminal System, Programmer's Manual (H20-0228), for further information on this point). The patch card format for this parameter is:

Card Columns	Contents
1-5	64N02
6	Word separator (0-5-8 punch)
7-8	New value of NAVB
9-71	Comment: NUMBER OF CORE BLOCKS
72-80	0400/////

Output Terminal Tape Drive

Messages for terminal 97, terminal 96 with sense switch B on, and terminal 98 with sense switch B on, are written on tape drive number 2.

On a 1460 system the tape drive number may be set at the tape drive. On a 1440 system with a 7335 Magnetic Tape Unit, Model 1, this number may be set by a switch on the console. If another tape drive number is desired in the program, a reassembly of the SECRD and SPRNT programs is necessary.

Storage Report Tape

A request for a storage report on tape will be honored only if terminal 97 has been specified as being attached, as described above.

When a storage report is written on tape, it is written on tape drive number 2. If another tape drive number is desired in the program, a reassembly of the RPORT program is required. The drive number cannot be patched in the COMPOOL.

Loading the System

After addresses have been written on drive 0 and the configuration parameter patches prepared, the system may be loaded. For this operation, drive 0 should be in normal status and ready. The console should be readied, and the programs, one on top of the other, should be placed in the card reader, DSKLD first. When the Load key is pressed, the programs will be written on the disk. As each program is written, the name of the program and its location will be logged on the console typewriter unless Sense Switch B is set ON (up). The card reader will pause on the last card, and the Start key must be pressed to read it. When the last program has been written out, the

program will halt with an I-address of 15957. The system is now ready for a normal start, as described in "Normal Operations" below.

NORMAL OPERATIONS

The normal duties of an ATS operator include cycling the system in the morning, requesting output during the day, and shutting down the system in the evening. The system will service the terminals without operator assistance.

If an ATS configuration does not have an IBM 1402 Card Read Punch or a 1442 Card Read Punch, it is necessary that the installation have access to an IBM 1401, or 1460 Data Processing System with a card reader and an IBM 1311 Disk Storage Drive to periodically update the program pack.

Cycling the System Using the Card Reader

ATS must be called from the disk whenever it is to be used. This is accomplished by readying the console and the disk drives, placing the CALLM program in the card reader, and pressing the Load key. CALLM calls the disk monitor (DSKMN) and gives it control. SDKMN turns on the Type light and the operator must type:

ATS RELEASE

where RELEASE means press the Release key. Dskmn will read ATS from the disk and give it control. The ATS program will type:

DATE PLEASE

The date typed at this point will be used to date storage reports and documents entered into Permanent Storage. The program will not continue beyond this point until an acceptable date has been entered. An acceptable date consists of a month (01-12), a day (01-31), and two digits of a year (65-69). June 1, 1965, for example, would be entered:

060165 RELEASE

If the date is not valid or if the Cancel key is pressed, the program will again type:

DATE PLEASE

and the date must be reentered. After an acceptable data has been entered, the system will cycle and be ready to accept requests from the terminals.

Cycling the System Using the Console

The procedure for cycling the system from the console is essentially the same as with a card reader, except that the CALLM program must be keyed into core storage beginning at location 15902. The program is:

,I9H001/H9IHIlBVI0I0011M(F0I8CWLI9HU60LI9Bl09L(Fl100RBI4G\

BI2EYM001U60)U60/110I8B*001685015bbbbb‡

where the wordmarked characters are indicated by an underscore.

After the CALLM program has been typed, the operator should manually branch to position 15902 and press the Start key. If the program was correctly entered, the Type light will be turned on. The procedure is then the same as if the CALLM Program was loaded from the card reader.

Shutting Down the System

The signal that shuts down the system is given from terminal 0. To perform this operation, the operator must first go online by taking the action:

ATTN U CR

followed by:

ATTN!s CR

The letter s stands for shutdown. The system will not shut down until every waiting program has finished its work. If shutdown is successful, control is given to the DSKMN program and the Type light will be turned on, and the operator can call the next program by typing its name. Often this will be the ATS Document Diagnostic program (ATSDD), described below. On a busy system the !s action may result in the message:

ILLEGAL ACTION

The operator should repeat the action:

ATTN!s CR

Permanent Storage Maintenance -- ATSDD

In order to assure the correctness of permanent storage on disk, the ATS Document Diagnostic program (ATSDD) may be run to check all documents in permanent storage. If any errors are detected, they are noted on the console typewriter. To use this program, ready the console and disk drives. Set all sense switches off (down), and load the CALLM program. (If ATS were cycling, ATTN !s CR would bring in DSKMN instead of CALLM.) When the Type light is turned on, type:

ATSDD RELEASE

The ATSDD program is called and immediately types:

X SECTORS USED FOR WORKING STORAGE ON Y

where X is the sector total and Y is the date. This message is omitted if ATS is not used between ATSDD runs.

The permanent storage diagnostic phase comes next. If a document is in error and cannot be repaired, ATSDD will delete the document and type:

DOCUMENT X **DELETED**

where X is the document number. This document must later be retrieved from the backup tape or disk (see below for backup procedures).

If part of a document falls below the lowest permanent storage address (LPSA) or above the highest permanent storage address (HPSA), the message:

DOCUMENT X OUT OF BOUNDS (Y)

is typed where X is the document number and Y is the half-track out of bounds. The document is not deleted. This situation may be remedied by updating the document (Get, Delete, and Store) when ATS is cycling.

If ATSDD is run before ATS deleting has been completed, ATSDD completes the deleting process and types:

DELETE CHAIN CLEARED

Since there must be a one-to-one correspondence between bits on in the Permanent Storage Bit Map and half-tracks used for documents, and a one-to-one correspondence between bits off in the bit map and half-tracks available for permanent storage, it is likely that correspondence will not exist if any of the diagnostic messages have appeared. ATSDD always forces a correct bit map, updates it on disk, and if it differed from the original bit map, types the message:

X HALF-TRACKS MADE AVAILABLE

where X is a number, if bits were turned off on the original bit map.

The message:

Y HALF-TRACKS PREVENTED FROM USE

where Y is a number, is typed if bits were turned on in the original bit map. The larger the two numbers become, the more serious the problem in permanent storage. The last phase of ATSDD types:

X HALF-TRACKS AVAILABLE FOR PERMANENT STORAGE

where X is the total number, and returns control to the DSKMN program. Another program may then be called by typing its name on the console typewriter when the Type light is turned on.

Permanent Storage Backup

Since it is possible for both the ATSDD program and terminal operators to delete documents that may still be needed, a backup of permanent storage is recommended. In addition to diagnosing permanent storage with the ATSDD program, it will write a backup tape of documents on disk. To use this option, ready the console and disk drives, and place a scratch tape on the drive used for writing archive documents. This tape drive is initially set for unit 1, but may have been altered. (See the section "Patching System Parameters".) Load the CALLM program and set Sense Switch B ON (up) for a backup of all documents stored that particular day, or Sense Switch C ON (up) for a backup of all documents that currently exist in ATS. When the Type light is turned on, type:

ATSDD RELEASE

After the working storage sector total has been typed, the message:

TODAY'S PERMANENT STORAGE ON TAPE

will be typed if sense switch B is on, or

ALL PERMANENT STORAGE ON TAPE

will be typed if sense switch C is on. In addition to writing the backup tape, all of the Permanent Storage diagnostics will still be performed. The backup tape will be in archive tape format and will have reel character Z. Each tape document number will be identical to the disk document number. For example, if document 99 were stored that day on disk, it would appear on tape with document number Z99. If the end of the tape reel occurs before all disk storage is transferred, the message:

MOUNT ANOTHER REEL

will be typed and the filled reel will be rewound. The operator may then place another reel on the same drive, ready it, and ATSDD will continue. The program ends by typing the half-track total, rewinding the tape reel, and returning control to the DSKMN program.

If an ATS configuration does not include any tape units, backup is accomplished by copying the ATS disk pack and 1301 modules to another set of disk packs. The IBM Disk Utility Program, Copy Disk (1401-UT-053 or 1440-UT-041), should be used for this purpose.

Retrieval from Backup Tapes -- ATSTR

If the ATSDD program found it necessary to delete some documents in permanent storage, it will be necessary to retrieve them from backup tape. If only a few documents were deleted by ATSDD, they could be retrieved as archive documents while ATS cycled. Take the ATTN ! RZn CR (n = tape drive number) and transfer them to disk in the usual fashion (see "Storage and Retrieval from Tape" in IBM 1440/1460 Administrative Terminal System, Terminal Operator's Manual (H20-0185).

If many documents were deleted, the regular tape retrieval program ATSTR, should be used. To use this program, ready the console, disk drives, and archive tape unit, set all sense switches off (down), load CALLM, and type:

ATSTR RELEASE

The message:

RESTORE THE TAPE DOCUMENTS THAT ARE NOT PRESENTLY ON DISK

will appear and the program will do just that. For example, suppose that thre are only two documents, 97 and 99, on disk and there are three documents on tape, Z96, Z97, and Z101. By running the tape under ATSTR control, Z96 will be transferred to 96, Z97 will be bypassed, and Z101 will be transferred to 101. At the end of each reel, the message:

COMPLETED

is typed and control is returned to the disk monitor (DSKMN). If ATSTR attempts to transfer a valid document from tape to disk, but permanent storage is completely filled in disk, the message:

END OF STORAGE

will appear and the program halts. Pressing Start calls in the DSKMN program. ATS may be cycled and unwanted documents deleted to allow more storage space or perhaps the upper and lower bounds of permanent storage could be expanded (see "Patching System Parameters").

If it is desired to completely clear all permanent storage on disk before restoring documents, ready the console, disk drives, and archive tape unit and load CALLM. Set Sense Switch B ON (up), and type:

ATSTR RELEASE

The message:

PUSH 'START' TO CLEAR ALL ATS STORAGE

will appear. After the Start key is pressed, the message:

RESTORE THE TAPE DOCUMENTS THAT ARE NOT PRESENTLY ON DISK

will appear and the program continues as above. If clearance of ATS storage is not wanted, press the Start Reset key and load CALLM.

One may question the desirability of clearing all ATS storage. There are at least two reasons for doing this. It may be necessary to decrease the permanent storage area on disk to allow additional room for user-written programs. By taking the complete backup (ATSDD with sense switch C on), adjusting LPSA and HPSA (see "Patching System Parameters"), and then clearing before retrieving (ATSTR with sense

switch B on), all permanent storage will be within the newly specified bounds. Another reason is that by taking the complete backup and clearing before retrieving, permanent storage will be packed in the smallest possible area sequentially. Response time for ATS Get and Store actions will be minimized and operating time for ATSDD will be considerably reduced. If it is necessary to restore the ATS system from a series of tapes (whether they be daily backups or complete backup), it is important that the most recent tape be used first, then the next most recent, etc. In this way the system will be left with the most up-to-date copy of each document in Permanent Storage.

Single Sector Disk Dump -- SSDD

The SSDD program will read and alter any disk sector selected by the operator. To operate SSDD, load the CALLM program and type:

SSDD RELEASE

When the SSDD program is loaded, it will cause the Type light to be turned on. The operator may then type a sector address. The program assumes the disks are written in the Load Mode since this is the mode used with all ATS packs. To read a disk sector in the Load Mode, type:

RELEASE

where # is the sector address (a one- to six-digit number).

For packs written in the Move Mode, the operator should type:

M SPACE # RELEASE

where SPACE means press the Space bar. All subsequent operations will be in the Move Mode and M SPACE need not be typed. To return to the Load Mode, the operator should type:

L SPACE # RELEASE

Sectors are displayed when the operator types the address of the sector and then presses the Release key. Leading zeros may be entered, but are not required. For example, to read sector 000027, the operator should type:

27 RELEASE

Sector 000027 would then be read from the disk and typed on the console. After this operation, the program will wait for the next instruction.

To alter all or part of a sector, it must first be read from the disk. The following request should then be typed:

A SPACE # RELEASE

where # is the character address within the sector where the alteration is to begin. It may range from 0-89 in the Load Mode and 0-99 in the Move Mode. For example:

A SPACE 24 RELEASE

allows the alteration of characters beginning at character 24 (the twenty-fifth character in the sector). The program will type all characters that precede the designated character, ending with a Carrier

Return. All characters subsequently typed by the operator will replace the corresponding characters in the sector when the Release key is pressed. Characters preceding the addressed character and any following the last character position entered at the console typewriter are preserved. Assume the operator wants to alter character 7 of sector 000575. After typing:

575 RELEASE

sector 000575 would be displayed on the console. The following action is then taken:

A SPACE 7 RELEASE

Characters 0 to 6 would be typed, followed by a Carrier Return. If a visual inspection shows that the wrong character will be altered, the Release key should be pressed. Otherwise the new character(s) should be typed and the Release key pressed. When the Release key is pressed, the altered sector is written on the disk. Additional alter requests to the same sector can be taken by typing:

A SPACE # RELEASE

where # is the new character address.

The program assumes it is modifying the sector last read from the disk.

SSDD will always type an error message if a disk error occurs. If the drive is not ready, the program will type:

THE ABOVE SECTOR IS INOPERABLE

If an improperly addressed pack is on the drive, the program will type:

ADDRESS COMPARE CHECK WHEN READING

The program initially assumes sequential addressing through all five drives. If a pack is addressed for a drive other than the one on which it is mounted, that particular drive may be selected and all subsequent requests will be directed to that drive. To do this, type:

D SPACE # RELEASE

where # is the drive selected. To return to the normal addressing format, type:

D SPACE * RELEASE

In addition to selecting 1311 disk drives, it is possible to select 1301 Disk Storage. This action is:

D SPACE) RELEASE

where the right parenthesis may print as a lozenge, depending on the print element on the console. To return to 1311 status with normal addressing, the action:

D SPACE * RELEASE

should be taken.

If a read operation is attempted in the wrong mode (Load Mode sectors read in Move Mode, or vice versa), the parity indicator is set and the program will type:

PARITY ERROR WHEN READING

After certain machine errors, the Wrong Length Record Indicator will be set and the program will type:

WRONG LENGTH RECORD CHECK WHEN READING

After any message, the Type light will come on, indicating that another request can be entered.

Control can be returned to the disk monitor program (DSKMN) by typing:

C RELEASE

ATS Core Dump -- CORED

If ATS should ever stop, a core dump should be taken to determine the cause of failure. Standard core dumps are not adequate since they do not print the special characters that are of interest to the ATS programmer. Groupmarks, tabs (left bracket), upshifts (greater than), downshifts (less than), and carrier returns (right bracket) do not print on the IBM 1403 Printer.

ATS Core Dump Output

The ATS core dump prints all unprintable characters by using a double-character representation. All 64 possible characters will be printed by the ATS core dump. The special double-character representations are:

Two-character Sequence (BCD Code)	Meaning
..	Colon
GR	Greater than
TM	Tapemark
/B	Alternate blank
WS	Word separator
*/	Backward slash
SM	Segment mark
MZ	Minus zero
*R	Right bracket
.,	Semicolon
*D	Delta character
PZ	Plus zero
*L	Left bracket
LS	Less than
GM	Groupmark

Two-character Sequence (Terminal Code)	Meaning
SP	Space
UP	Upshift
DM	Dummy character
AT	Attention character
EX	Exclamation mark
CR	Carrier return
BK	Backspace
.,	Semicolon
TB	Tab character
DW	Downshift

Data fields are represented by two or three lines of print; for example:

```
800   .......... .....-..-.
      GYOSU XPSX UYUV*L 2G=
      R              RS  R
820   .....-.... ..........
      JRA9 GROAS PY $ZUS NU
           R
```

The first line contains the high-order address of the field followed by periods and dashes. A period indicates that the position is not wordmarked, a dash indicates that it is wordmarked. The second line

contains the data that occupied the core position or the first of a two-character sequence for a special character. The third line contains the second character of a two-character sequence.

CORED has the ability to distinguish instructions from data with adequate accuracy. Instructions are printed with SPS mnemonics and addresses converted to five digits with indexing; for example:

```
1383  BCE   1678,15999+X2,*R
1391  BCE   1608,15999+X2,WS
1399  BWZ   1525,9206+X1,2
1407  BBE   2260,9207+X1,-
1415  MZ    5778,9207+X1
1422  SBR   94,3
```

It is not necessary to convey any parameters to the program. The 1440 is distinguished from the 1401 or 1460 by the bootstrap cards. The program consists of three overlays and a card bootstrap. The three overlays are disk resident.

ATS Core Dump Operation

To operate the ATS core dump, ready the console, place the CORED card bootstrap in the reader, and press the Load key. The message:

GROUPMARK/WORDMARKS

will type on the console printer followed by the addresses of any groupmark/wordmarks discovered in positions 81 to 999. This area is then written to the disk and CORED is read from the disk. The RAMAC light on the console will be on during this phase of the dump. CORED scans positions 1000 to 7200 for groupmark/wordmarks, prints their addresses on the console printer, saves the area on the disk, and calls the first overlay, CORE1. CORE1 prints a heading, and calls the second overlay, CORE2. CORE2 scans and interprets core beginning with the core saved by the bootstrap.

OPERATION OF ADDITIONAL ATS FEATURES

PERMANENT STORAGE TAPE

In many installations, it is desirable to transfer seldom referenced documents to tape in order to free disk storage. A single alphabetic character label must first be written on a Permanent Storage (Archive) Tape before it can be used. Permanent Storage Tape reels are usually named A, B, C, etc. Note that the letter Z is used by the ATSDD program when writing Permanent Storage backup tapes in archive tape form. Users may not want to use this character for other archive tapes.

To write the initial header label, the operator should mount a tape on the archive tape drive and take the action:

ATTN !rX TAB new CR

where X is the alphabetic reel name. At that time, the tape will be initialized to receive documents. To initialize reel A, for example, the action would be:

ATTN !ra TAB new CR

To ready an archive tape that has previously been initialized, the tape should be mounted on a drive of the operator's choice, and the following action taken:

ATTN !rX# CR

where X is the alphabetic reel name, and # is the number of the drive on which it is mounted. An archive tape document may be read from any drive. Writing an archive tape, however, will occur only on one particular drive. This drive is established by a patch in the COMPOOL (see "Patching System Parameters"). If the operator attempts to ready a tape that has not been initialized, the system will type:

ILLEGAL ACTION

and ignore the request.

An archive tape should never be made manually unready. When a tape is to be demounted, the following action should be taken:

ATTN !rX CR

where X is the reel name. The system will then rewind the tape, permitting the drive to be used for other purposes.

Since it is not possible for the program to test the ready status of a drive, the operator must exercise care in taking these actions.

Only the number of tape drives limits the number of tapes that may be mounted and made ready.

STORAGE REPORT ON PRINTER OR TAPE

A request for a storage report to be output on a high-speed printer or magnetic tape may be made only from terminal zero. The output device requested must be readied before the request is made. The system must also be patched to indicate that the desired device--high-speed printer (terminal 98), or magnetic tape (terminal 97)--is attached (see "Patching System Parameters").

The storage report program (RPORT) has a very low priority. Therefore, it is subject to delays when there is high activity in the system. During the time that it is operating, both terminal 0 and the output device will be unavailable for other uses. If it is desired to discontinue preparation of a storage report while it is being output on the high-speed printer or magnetic tape, the operator may set Sense Switch F ON (up). This will terminate preparation of the report. A new request for the storage report must be made at a later time. This new request may start at the hundreds-group of documents following the last hundreds group fully processed.

When the requested report is completed, the message

END OF JOB

will be output on the specified device and terminal 0 will be unlocked.

In examining the output of this program, it should be noted that the letter L will appear in the identification of a document instead of the numeral one, unless the terminal that entered the identification was using a Manifold typehead.

SYSTEM OUTPUT

ATS permits messages to be sent from one terminal to any other terminal on the system (see IBM 1440/1460 Administrative Terminal System, Terminal Operator's Manual (H20-0185). These messages are not printed immediately, but wait until retrieved by the operator of the receiving terminal. This message facility also includes special output devices. These special output device terminals are numbered as follows:

Terminal	Device
99	Card punch
98	Printout with line numbers
97	Magnetic tape
96	Upper- and lowercase chain printer

Messages for these output devices can be received only by an action at terminal 0, since only the console operator knows the ready status of these devices. Output messages can be accepted by first readying the output device and then taking the action:

ATTN m9# CR

from terminal 0 (9# is the terminal number of the device). All of the waiting messages for the device are retrieved and processed. When all messages have been processed, or if no message is waiting, the system will type:

NONE

The operator may then request output for another device.

Setting Sense Switch D ON (up) will terminate message processing at the end of the current message and the system will type:

CLEARED

Terminal 99 -- Card Punch

The card punch is the only output device that interferes with terminal operation. Consequently, messages for the punch should be retrieved only when system activity is at a minimum. Before these messages are requested, the card punch should be placed in the ready status. Cards within the mechanism should be run out by lifting the cards out of the hopper and pressing the Non-Process Runout key. Pressing the Start key will start the punch mechanism running and reset the hardware interlocks. At this point the action:

ATTN m99 CR

should be taken at terminal 0. All of the documents for the punch will be retrieved and punched into cards. Start and End cards, with the number of the terminal that transmitted the card images, precede and follow each card deck to make separation possible. These cards have the following format:

START ## START ## START ## START ##

END ## END ## END ## END ## END ##

where ## is the terminal number from which the card deck was transmitted. If the punch should stop because of a feed error, the cards in the hopper must be lifted out and the Non-Process Runout key pressed. This will run the mispunched cards out of the mechanism. When blank cards are replaced in the hopper and the Start key is pressed, punching will resume with the card image in error.

Terminal 98 -- Printout with Line Numbers

Before printouts with line numbers are requested, the printer must be ready. This is accomplished by engaging the chain on the 1403 Printer and pressing the Start key after the Print Ready light comes on. The 1443 Printer is readied by setting the Remove Typebar Switch to the ON position and pressing the Start key. When the printer is ready, the action:

ATTN m98 CR

should be taken at terminal 0. At that time, all of the waiting documents for terminal 98 will be printed. Documents are separated from each other by a page containing a start line at the beginning of the document and an end line at the end of the document. As in the case of punched card output, these lines contain the number of the transmitting terminal so that the listings can be returned to the appropriate terminal operators.

If printer 1 is being used for peripheral purposes, the output that ordinarily would be printed may be sent to a tape mounted on the Output Terminal tape drive (see "Patching System Parameters"). This is done by setting Sense Switch B ON (up) before taking the ATTN m98 CR action. A tapemark will be written after every document, and two tapemarks will be written after the last document. The 133-character records may be printed using any standard tape-to-printer program.

Terminal 97 -- Card Image Magnetic Tape

Output for terminal 97 is written on tape drive 2. When the tape is ready, the action:

ATTN m97 CR

should be taken at terminal 0. At that time, all of the messages for the tape will be written. The tape will contain 80-column unblocked card images of the input keyed at the transmitting terminal. Tapemarks are not automatically generated. The terminal operator generating the document must key a tapemark before transmitting the document if one is required by the program that is to read the tape. The tapemark is a 7-8 punch. To place a tapemark at the end of a document, the following characters should be keyed at the left margin on the last line of the document:

7 BKSP 8 CR

Terminal 96 -- Upper- and Lowercase Chain Printer

The output for the upper- and lowercase chain is formatted to look as if it had been typed at the terminal. To receive the messages for terminal 96, the printer should be in the ready status and Sense Switch B set OFF (down). When the printer is ready, the action:

ATTN m96 CR

should be taken at terminal 0. All of the waiting documents will then be printed. If the upper- and lowercase chain is not installed on the system but is available on another computer, a tape should be mounted on the Output Terminal Tape (see "Patching System Parameters") and readied, and Sense Switch B set ON (up). The print line images will then be written on this tape.

System Output -- Alternate Procedure

When a document is transmitted to an output device, it occupies a temporary location in Permanent Storage. When the console operator requests the messages for a device, the first message in the queue is loaded into Working Storage for terminal 0. From there, it is formatted into print, tape, or card images, and is written to the proper device. After the document has been formatted and written, Working Storage is cleared, and the next waiting document is obtained. An alternate approach permits the console operator to selectively get a document into terminal 0 Working Storage using the standard Get request. Once the document is in Working Storage, it may be transmitted directly to an output device by the action:

ATTN !9# CR

where 9# is the number of the output device. The appropriate terminal 0 actions are listed below:

Action	Device
ATTN !99 CR	Punch
ATTN !98 CR	Printout with line numbers
ATTN !97 CR	Tape
ATTN !96 CR	Upper- and Lowercase Chain Printer

This method of obtaining system output is much faster than transmitting documents from individual terminal stations, since the storage and deletion of the usually long "messages" (output documents) is bypassed. For this reason, some ATS installations may want their terminal operators to send short messages to terminal 0, indicating the location of their output documents, the devices to which they are to be sent, and where to send the output. When his time and system load permits, the console operator can retrieve the documents and transmit them directly to the proper output devices.

CARD AND TAPE INPUT

It is possible to enter documents into ATS from cards or tape. Either of two input modes may be used: Card Image Mode or Document Mode. A control card must be used for the Document Mode and is strongly recommended for the Card Image Mode as well. These cards will be described in the following sections. The action in either case is identical:

ATTN !cd CR

for card-to-disk, and

ATTN !td CR

for tape-to-disk. The system will load the input into Working Storage for terminal 0 and will stop at the first tapemark encountered in position one of a record. At that time, the system will print the next number to be assigned to input text as an indication of the number of lines or units that were entered. For card input, this operation appears on the terminal as follows:

```
!cd
NEXT NUMBER -- X
```

where X is four more than the number of lines or units entered, assuming that a control card was used.

The first card of an input deck should be a control card. The last three cards should be a special End card and two blank cards. The End card has a tapemark (7-8 punch) in column 1 (all other columns are ignored by the program). The two blank cards that follow the End card prevent the card reader from stopping the system when it has read the last card. A complete input deck will appear as shown in Figure 6.

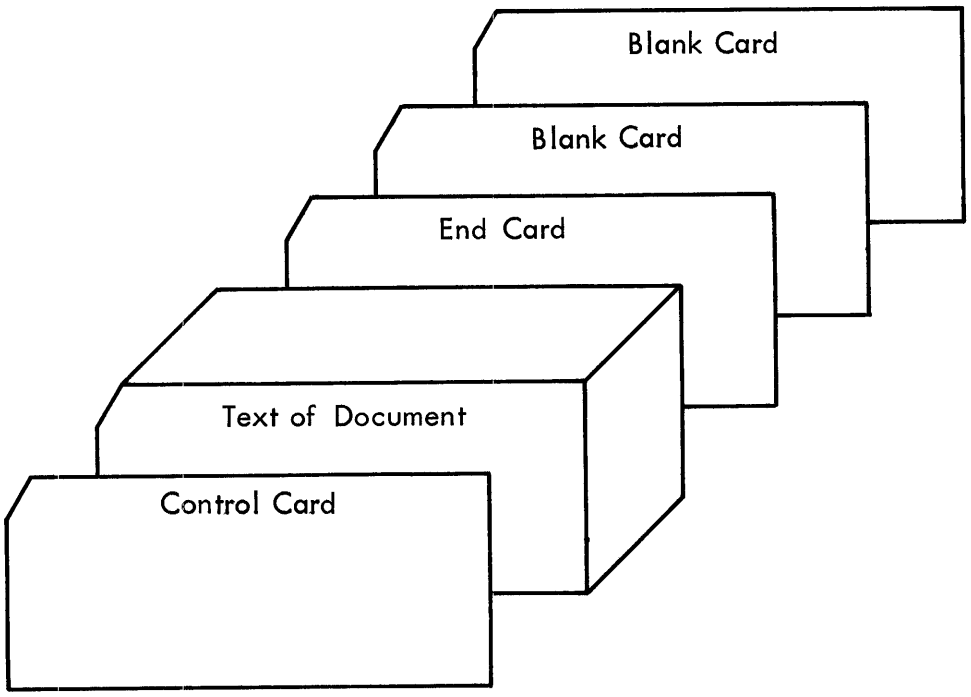


Figure 6. Card deck for document input

For tape input, the program expects the tape to be mounted and ready on drive 1. The first record should be a control card image and the last record a tapemark.

Before the operation is started, the input device should be ready. In the case of the card reader, the deck should be placed in the hopper and the Start key pressed. This will reset the hardware interlocks and start the motor. In the case of tape input, the tape should be at load point and ready. The printer is not used in this operation.

Card Image Mode

The Card Image Mode will load cards or tapes in normal BCD format and create an 80-80 duplicate in terminal 0 Working Storage. This document will look as if the operator had keyed the document at the terminal in the Keypunch Mode (see "Keypunching" in IBM 1440/1460 Administrative Terminal System, Terminal Operator's Manual (H20-0185). All special characters will be converted to ATS multipunching. The groupmark, for example, will be converted to:

H BKSP 7

The character H (12-8 punch), plus the 7 punch, yields a 12-7-8 punch or a groupmark. If the created document is not altered by the control card, an exact duplicate of the input will be obtained when transmitting it back to cards or tape.

The control card for Card Image Mode is like the control card used in the Keypunch Mode when keying at the terminal. It is loaded into Working Storage in the Heading Mode and may be used as a control card when transmitting back to cards or tape. A control card may appear as follows:

```
                                                    8
Column: 1                                           0

        MSSS-T-------T---T--  ----T-----T------DD
```

Code

T — The T defines the beginning of a field. If an input deck has fields beginning in columns 6, 16, 21, and 40, the control card should have a T in those positions. The T allows the system to generate a tab character to cross spaces between the end of one field and the beginning of the next. Since the tab is a single character, less space on the disk is taken than if spaces were generated.

\- — The dash indicates that valid data will exist in the corresponding columns in the input deck.

D — The D has the same meaning as the dash on input. When transmitting back to cards or tape, however, it has the function of the duplicate key on a keypunch.

M — The M character (meaning Margin) suppresses the characters in the corresponding columns. If used, these characters must be continuous, beginning at column 1. M's punched in columns 1 to 5, for example, cause those columns to be ignored and loading to begin at column 6. When the same control card is used to transmit to cards or tape, the characters will again appear in column 6, but columns 1 through 5 will be blank.

S — The S character, when transmitting to cards or tape, causes sequence numbering. On input, the S suppresses all data in the corresponding columns. By using S's in the appropriate columns of a control card, incorrect sequence numbers can be blanked out when an input deck is loaded. When returning to cards or tape, the same control card will cause the deck to be properly sequence-numbered.

The control card must be continuous from column 1 to the last column of valid input. No data will be loaded beyond the end of the control card. If, for example, the control card extends from columns 1 through 40, the data in columns 41 through 80 will not be loaded into the system. If the system does not recognize the first card of the input deck as a control card, it is loaded as data. Input decks without control cards are loaded in an 80-80 format.

Document Mode

Some installations may have documents generated by other programming systems. These documents may be loaded into ATS in normal document format including Automatic and Uncontrolled Modes, Heading and Footing Modes, and Plus-Lines action. Control characters, such as upshifts, downshifts, and tabs, will not be converted to multipunched special characters. They will be loaded as part of the document. The control card that indicates the Document Mode consists of an X in column 1 and dashes throughout the rest of the card, as follows:

```
                                                    8
Column:1                                            0
       X---------------------  ----------------------
```

Input in the Document Mode may be either cards or unblocked 80- or 81-character tape records. The input must resemble a serial text stream as might be keyed from a terminal, including functional characters in the appropriate places. Carrier Return characters are supplied automatically at the end of the last printing character. An input line might look like this:

TAB TAB UPSHIFT T DOWNSHIFT HIS IS A DOCUMENT.

The following are acceptable functional characters:

Function	Character	Card Code	BCD
Upshift	Greater than	6-8	842
Downshift	Less than	12-6-8	BA842
Tab	Left bracket	12-5-8	BA841
Backspace	Semicolon	11-6-8	B842
Space	Blank		
Attention	Word separator	0-5-8	A841
Stop code	Record mark	0-2-8	A82

Special function characters, other than those named above, are invalid in the text mode. If they are encountered during text mode input, they will be ignored. These characters are as follows:

Function	Character	Card Code	BCD
Carrier return	Right bracket	11-5-8	B841
None	Colon	5-8	841
None	Tapemark	7-8	8421
None	Backward Slash	0-6-8	A842
None	Segment Mark	0-7-8	A8421
None	Delta	11-7-8	B8421
None	Groupmark	12-7-8	BA8421

It is possible to enter every printing character on the Courier 72 typehead, except the semicolon and the colon. The card codes for entering the 26 lowercase alphabetic characters are the standard alphabetic card codes. The same card codes are used for the 26 uppercase alphabetic characters, except that they must be preceded by an upshift character, that is, a 6-8 punch, in some preceding column of the same card. The digits 2 through 9 and 0 are entered as lowercase with their standard numeric card codes. Other characters are entered as shown in the following table. Note the importance of entering the special characters with the correct shift code ahead of them.

Courier 72 Character	Preceding Shift Code in CARD	Card Code	Remarks
]	Downshift	1	The numeral one is entered as a lowercase letter "L".
[	Upshift	1	
@	Upshift	2	
#	Upshift	3	
$	Upshift	4	May also use Upshift 11-3-8 punch.
%	Upshift	5	
¢	Upshift	6	May also use Upshift 2-8 punch.
&	Upshift	7	
*	Upshift	8	May also use Upshift 11-4-8 punch.
(	Upshift	9	May also use Upshift 0-4-8 punch.
)	Upshift	0	May also use Upshift 12-4-8 punch.
-	Downshift	11	
	Upshift	11	
=	Downshift	3-8	May also use Downshift 12 punch.
+	Upshift	3-8	May also use Upshift 12 punch.
!	Downshift	11-0	
°	Upshift	11-0	
'	Downshift	4-8	
"	Upshift	4-8	
,	either	0-3-8	
.	either	12-3-8	
/	Downshift	0-1	May also use Downshift 12-0 punch.
?	Upshift	0-1	May also use Upshift 12-0 punch.

Modes of Stored Text

The loading of the input text will correspond to the mode of terminal 0. The sequence:

```
u
UNCONTROLLED MODE
lcd
```

will cause the first card to be loaded in the Uncontrolled Mode. To begin the input stream in a known mode, the second card, following the control card, should be a mode request. Mode requests are entered when an Attention character in column 1 is followed by a mode request. An AUTOMATIC Mode request would appear as follows:

Col. 1	Col. 2
ATTN	A

All other Attention actions are entered in the same manner, on separate cards beginning at column 1. These actions are as follows:

Automatic Mode	ATTN A
Uncontrolled Mode	ATTN U
Centering Mode	ATTN UC
Heading Mode	ATTN H
Footing Mode	ATTN F
Plus Lines	ATTN + (DIGITS)
Format Control	ATTN A (DIGITS)
Format Control	ATTN U (DIGITS)

Units in Stored Text

In the Uncontrolled Mode, each card image is one unit. In the Automatic Mode, however, the end of a unit must be indicated by a blank card, which is analogous to the double Carrier Return. For example:

Card	Unit	
1	1	ATTN A
2	2	UPSHIFT N DOWNSHIFT OW IS THE
3	2	TIME.
4	2	Blank

The loading of the document will end when a tapemark (7-8 punch) is encountered in the first column of a card or when a tapemark is found in the first position of a record read from the tape.

WARNING: If a 7-8 punch is not found in column 1 of some card in a deck being loaded with the !cd action, the card reader will stop and hang up the entire system when the last card in the deck has been read. Reading a card with a 7-8 punch in column 1 will cause ATS to cycle properly again.

Peripheral programs are not usually related to servicing the terminals. They perform unrelated background functions such as card-to-tape or tape-to-printer operations. A peripheral program must first be brought into core storage from the disk before it can be used. This is accomplished by taking the following action from terminal 0:

ATTN !p TAB xxxxx CR

where XXXXX is the name of the desired program (up to five letters). Three ATS peripheral programs are MDLPP (Model Peripheral Program), ARCRT (Archive Tape Report), and DSKDM (Disk Dump). MDLPP is a model for those who wish to write their own peripheral programs. It is not a supported part of ATS.

For example, DSKDM may be called in by typing:

ATTN !P TAB DSKDM CR

If the action is taken correctly, the print element will "wiggle". If the action is not correct, the system will type:

ILLEGAL ACTION

and ignore the request.

The sense switches are usually used to communicate to peripheral programs. The sense switch settings for DSKDM are described in the next section.

CAUTION: Peripheral programs cannot be used unless space is reserved for them when allocating core blocks (see "Patching System Parameters").

Disk Dump -- DSKDM

The Disk Dump program is an online debugging tool used to log all disk reads and writes on an IBM 1403 or 1443 Printer. As distributed, DSKDM is assembled so that a maximum of 40 core blocks may be assigned if it is to be used. It may be called in by typing:

ATTN !p TAB DSKDM CR

When DSKDM is in core, it will log all disk operations when Sense Switch C is ON (up), however Sense Switch C must not be turned ON until DSKDM is in core. If Sense Switch B is OFF (down) the logging will be on printer number one, if it is set ON (up) the logging will be on magnetic tape drive number one. Many of the keystrokes received from the terminals correspond to graphics that do not ordinarily print on the IBM 1403 or 1443 Printers. These characters are printed in the same double-character representation used in the ATS Core Dump. The contents of text blocks, their core location, and a read or write indicator are printed. If the sector count is a multiple of 10, the sector content is omitted on the printing. A sample of DSKDM output appears below:

```
 5890  R  *000200020
 7690  R  *000220010
 5890  R  *000280020
 5890  R  *000510020
 7690  R  *000530010
10100  W  -.-..... -...-.....
          *019999001 LWT*L$222*
                     SS RS    R
```

The number on the left is the core address of the disk control field. R or W indicates a read or write. The next ten characters are the disk control field. The first five lines are programs and program overlays. The last three lines represent a text block. A dash over a character indicates a wordmark; a period represents a non-wordmarked character. The block is divided into ten-character segments. The meaning of the double-character representation is the same as in the ATS Core Dump program discussed above.

NOTE: DSKDM degrades system response at the terminals; it should not be used during normal operations of ATS. However, DSKDM must be loaded with the ATS program on disk if any peripheral programs are to be used.

Archive Tape Report - ARCRT

ARCRT produces a storage report on the high-speed printer of the contents of an ATS Permanent Storage Tape. As distributed, the program is assembled so that a maximum of 40 core blocks may be assigned if it is to be used. Sense switches C, D, E, and F should all be set off (down) before ARCRT is called in. It may be called in by typing:

ATTN !p TAB ARCRT CR

The Permanent Storage Tape reel about which the report is to be made, must be mounted on tape drive number 1. The sense switches that control program operation must not be set until the tape drive and printer have been readied. The functions of these switches are:

Sense Switch	Function
D	If sense switch D is on (up), execution of the peripheral program will be terminated after a SEQUENCE CHECK or BAD TAPE RECORD message is printed. If sense switch D is off (down), program execution will continue after these messages are printed.
E	Sense switch E controls the execution of the program. In the off (down) position, the program will not execute even though it is in core storage. This switch should be set on (up) to start execution of the program and will normally be left in this position until the END OF JOB message is printed. However, if it is necessary to interrupt execution of this program to allow some other program to use the high-speed printer, this switch may be set off (down). Execution of the program will resume when the switch is set on (up).

The following messages may be printed during execution of this program:

SEQUENCE CHECK -- This means that the identification number of the last document read on the Permanent Storage Tape is equal to or less than the identification number of the preceding document. This will be followed by an END OF JOB message if sense switch D is on.

BAD TAPE RECORD -- This means that an uncorrectable error has occurred in reading the Permanent Storage Tape. This will be followed by an END OF JOB message if sense switch D is on.

WRONG TAPE MOUNTED -- This means that the first record of the tape mounted on tape drive number 1 does not have the expected format. The tape is rewound and unloaded and an END OF JOB message is printed.

ERR. IN REC. CT. -- This means that the document size indicated in a document header does not agree with the number of tape records found on the Permanent Storage Tape. Execution of the program will continue.

END OF JOB -- This means that program execution has terminated. Normally this message is printed after a tapemark is read on the Permanent Storage Tape. If another report is wanted, the program must be called in again from terminal 0.

Model Peripheral Program -- MDLPP

MDLPP processes tapes for IBM 7070/7074 or IBM 7090/7094 Data Processing Systems. It will print output and prepare input tapes for either system. It requires 2000 positions of core storage, hence, a maximum of 40 core blocks may be assigned if it is to be used. The functions of the four sense switches are described below. They should be set before MDLPP is called into core. It may be called in by typing:

ATTN !p TAB MDLPP CR

Sense Switch	Function
D	If sense switch D is on (up), the program will ignore carriage control characters when printing output tapes.
E	Sense switch E controls card reading. When MDLPP is in core and E is in the on (up) position, the program will expect cards in the reader and an output tape mounted and ready on drive 2. If a 7090 input tape is to be created, the printer must be ready, as all cards containing a $ in column 1 will be logged. MDLPP will write the tape according to the setting of sense switch F. It will write a tapemark when a card containing a 7-8 punch in column 1 is encountered. The operation ends when two such cards occur consecutively. Thus the end of the input deck should be two cards containing 7-8 punches in column 1, followed by two blank cards.
F	Sense switch F controls the mode of the operation. The on (up) position indicates the 7090 mode, the off (down) position indicates the 7070 mode.

G Sense switch G controls the printing of output tapes. When G is on (up), the program expects an output tape mounted on drive 1 and the printer in ready status. The operation will stop at the first tapemark encountered if 7070 mode, or the first two consecutive tapemarks if 7090 mode. If more than one file is on a single print tape, sense switch G should be turned off, then back on between jobs to print the entire tape. Sense switch F indicates the mode used when the tape was created.

Cards are written on tape in unblocked records. In the 7090 mode, the program accepts intermixed Hollerith and binary cards and writes the appropriate lookahead bits. A binary card always has a 7-9 punch in column 1. $DATA, $EOF, and $STOP cards will be logged on the printer and will cause a tapemark to be written on tape. Hollerith records are written in even parity; binary records are written in odd parity. In the 7070 mode, the records are in 80-81 format and in even parity.

Print tapes are read from drive 1 in the mode determined by sense switch F. The tape may contain as many as five 132-character print lines per record. If sense switch D is off (down), MDLPP will interpret the first character of every print line as follows:

Character	Carriage Control
Blank	None
0	Single-space before print
-	Double-space before print
+	Space suppress after print
None of the above	Eject page

If sense switch D is on (up), the characters in column 1 will not be examined, but will be printed.

TROUBLESHOOTING THE SYSTEM

With any large programming system, undetected program errors are always possible. There are also a few common operational problems that will occur in most installations.

TERMINAL PROBLEMS

The following is a list of terminal difficulties frequently encountered:

1. Problem: A terminal operator complains that the terminal will not respond.

   Solution: Dial the status of the 1448 line for that terminal. If the status is Control (CTL), the program is still processing a request for that terminal and will not allow the operator to continue until it is finished. If the status is Transmit (TSM), the operator should turn the terminal (or 1051 Control Unit) off, then back on, wait a few seconds, and strike the Carrier Return key. If this does not correct the problem, an IBM representative should be called. If the status is Receive-Idle (REC-IDL), Receive-Check (REC-CHK), or Receive End of Storage (REC-ESA), have the operator turn the terminal (or 1051 Control Unit) off, then back on, wait a few seconds, and strike the Carrier Return key. If this does not correct the problem, an IBM representative should be called.

2. Problem: The operator complains that the printout is unacceptable.

   Solution: Most output problems are caused by improperly set tab stops. The tab stops must be mechanically set on the terminal and their positions conveyed to the program by the ATTN ! action, followed by a sequence of t's and dashes. Never assume that the operator has set the tabs correctly. If the tabs are properly set and the printout is still unacceptable, check that there are not more tabs on a line than have been indicated by the ATTN ! action. For example, if the program has been told there are five tab stops and the operator tabs six times, the computer will never emit a tab after the print element passes the fifth tab position. If the tabs are set properly and the program is not justifying when the justify request is taken, the text has probably been entered in the Uncontrolled Mode, and will not be justified. If incorrect characters are being printed at the terminal, call out the units in question to correct them. If they are still in error, an IBM representative should be called.

3. Problem: A terminal receives the GO ON-LINE message even though it has made a request for the Automatic or Uncontrolled Mode in the approved fashion.

   Solution: This problem occurs when too few core blocks have been assigned. If the terminal attempts to go online when there are no available core blocks, the program will type the message GO ON-LINE and ignore the request. This message will also be received when a terminal is offline and takes any Attention action except ATTN A or ATTN U. Before assuming that the program has no core blocks, check the request to be certain that the exact sequence:

ATTN a CR
or
ATTN u CR

was typed at the left margin. If the request was valid, the number of core blocks should be increased at the earliest opportunity.

4. Problem: An operator has forgotten the lockword of a document in Permanent Storage.

Solution: The lockword can be determined by computing the index entry for the document number by the method previously described. When ATS is not cycling, the index sector should be read using the Single Sector Disk Dump. The index entry for the document will contain the address of the first half-track of the document (low-order zero understood). Positions 80-84 of the first sector of this half-track will contain the lockword. After the lockword is translated to terminal code the document may be deleted when the system is cycled normally. Another approach is to change the lockword to delta characters. It is important that the wordmark in character position 80 be entered. This procedure avoids the requirement of translating the lockword. It does introduce the possibility of destroying a valid lockword if a mistake were made in computing the index entry.

PROGRAM HALTS AND CHECK RESETS

Console Procedure

ATS will halt only if it detects an irrecoverable error condition. If the system halts or causes a Check Reset, DO NOT PRESS START. Record the lights and addresses displayed on the console. When the I ADD REG key is pressed, the address of the instruction following the stop will be displayed in the Storage Address lights. Next the B ADD REG key should be pressed and the Storage Address register recorded. The final operation is to dump core using the ATS Core Dump program. When the dump is finished, the system should be restarted using the ATS bootstrap program. Core locations 5906 and 5907 hold the number of the terminal being serviced at the time of the stop. This is printed on the core dump. If possible, the output on that terminal should be retrieved to help isolate the cause of failure.

NOTE: Unless the procedure outlined above is followed, and all the requested information is available for submission, do not call on the local IBM Systems Engineer for assistance in locating possible program difficulties with ATS.

Check Reset Conditions

The Check Reset condition will occur if the processor attempts to execute an invalid instruction, wraps core, or generates characters in bad parity. This latter error can occur if the program transmits a groupmark to the 1448. A list of common Check Reset failures is given below. In all cases, the processor will stop (no Stop light) and the Check Reset light will be on.

Cause	Display
Illegal 1448 Communication	The Operation register (OP) will always contain an O (B and 6 bits).
Parity Error	The red label above the A-register, B-register, Storage Address register, or any combination of the above, will be lighted, and one or more characters displayed in these registers will have an even number of bits.
Invalid Instruction	The Operation register (OP) will contain the invalid instruction.
Wrap Core	The red label above the A-register or B-register will be lighted, and 15999 or 00000 will be displayed in the Storage Address register.

Program Halts

Except where noted below, these halts may be caused by disk errors that persist after seven attempts. They may also be caused by obscure program difficulties that cause illegal disk control fields.

The application program in the Overlay Area (core positions 5900 to 7700) at the time of a halt can be determined by examining the contents of core positions 5894-5897 in the core dump taken at the time of the halt. The operator should not attempt to examine these positions from the console. He should immediately note the console lights, take a core dump, and restart the system as noted above.

Program	5894-5897	I-Address	Remarks
SCHED	any	1906	Illegal character after record mark in text stream being output to a terminal.
		3238	Attempting to read an application program.
		3333	No list entries available.
		4221	Double purging of Disk Block addresses.
		4443	Attempting Working Storage input/output.
		4629	No core blocks available.
		4781	No list entries available.
EUNIT	any	5695	
HSKPG	?	8093	This program is only in core on system start, before any terminal activity is allowed.
FRPRT	0100	7272	

ATTEN	0200	6998 7524 7586	
MISAC	0230	7396 7476 7779 8084	
COINS	0320	7377 7498	
BUKOP	0400	6896	
GETDC	0480	7389	
FILEP	0500	6522	Illegal program communication
		6917 7994	
STORE	0560	6153	
SECRD	0800	7279	
SPRNT	0840	6045 7416	
REDTP	0870	6522	
WRTTP	0900	6671	
DELET	0940	6580	
RPORT	0960	7323	
KLCUT	1000	7105	
CRDSL	1090	5944 7660 8038	
PERPT	1120	7323	

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